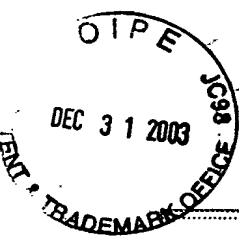


BEST AVAILABLE COPY

## PATENT ABSTRACTS OF JAPAN



(11)Publication number : 07-137266

(43)Date of publication of application : 30.05.1995

(51)Int.Cl.

B41J 2/16

B41J 2/045

B41J 2/055

RECEIVED  
JAN 09 2004  
TECHNOLOGY CENTER R3700

(21)Application number : 05-288092

(71)Applicant : FUJITSU LTD

(22)Date of filing : 17.11.1993

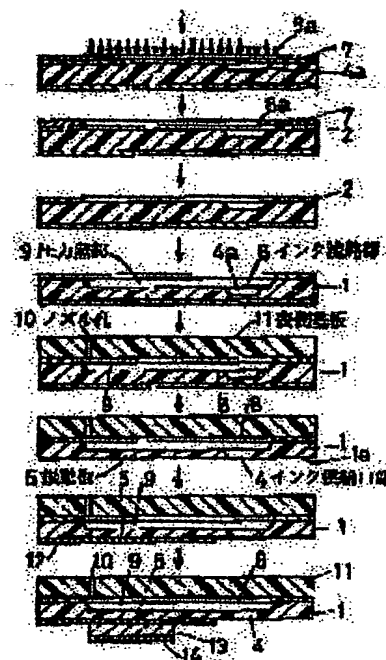
(72)Inventor : SAKAMOTO YOSHIKI  
TANIGUCHI OSAMU  
IWAISHI AKIRA

## (54) MANUFACTURE OF JET HEAD

## (57)Abstract:

**PURPOSE:** To efficiently produce an ink jet head of a high quality in which an ink supply port is disposed at a rear side.

**CONSTITUTION:** A recess 4a to become an ink supply port 4 is etched to a depth larger than a thickness size of a vibrating plate 5 from a front side of a rear side substrate 1 previously formed with an etching protective film 2 on both side surfaces, and an ink channel 8 and a pressure chamber 9 are subsequently formed by etching from a front side of the substrate 1. Then, a front side substrate 11 in which a nozzle hole 10 is opened is connected to the substrate 11, a wall of the chamber 9 at a rear side is so ground or polished to form the plate 5 having a predetermined thickness, thereby forming, the port 4 by opening the recess 4a at the rear side of the substrate 1.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's]

decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

**\* NOTICES \***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**CLAIMS**

---

**[Claim(s)]**

[Claim 1] As opposed to the background substrate (1) which formed the protective coat (2) to etching in both sides beforehand from the side front The depression (4a) used as the ink feed-hopper section (4) is formed in the bigger depth than the thickness size of a diaphragm (5) by etching processing. Then, the pressure room section (9) which stands in a row in the ink passage section (8) and it so that the above-mentioned depression (4a) may be included inside is formed from the side front by etching processing to the above-mentioned background substrate (1). It joins to the above-mentioned background substrate (1). next, a nozzle — the side-front substrate (11) in which the hole (10) was drilled — the nozzle — so that a hole (10) may carry out opening toward the above-mentioned pressure room section (9) Or it polishes. in order to use the wall of the background of the above-mentioned pressure room section (9) as the diaphragm (5) of predetermined thickness — the rear face of the above-mentioned background substrate (1) — grinding — The manufacture method of an ink-jet head that the above-mentioned depression (4a) carries out opening to the rear-face side of the above-mentioned background substrate (1), and is characterized by the ink feed-hopper section (4) and the bird clapper by it.

[Claim 2] The manufacture method of an ink-jet head according to claim 1 of having been made to perform junction to the above-mentioned background substrate (1) and a side-front substrate (11) after the grinding of the rear face of the above-mentioned background substrate (1), or the process of polishing.

---

[Translation done.]

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

### [Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacture method of the drops type ink-jet head on demand for recording by making an ink drop breathe out.

[0002] An ink-jet recording method is easy structure, and colorization tends to carry out it, it has the features, like there is also no noise, and is expected as a future recording method being in use.

[0003]

[Description of the Prior Art] as a conventional ink-jet head, it is shown in drawing 4 — as — a nozzle — there are some which joined the side-front substrate 52 in which the hole 51 was drilled to the background substrate 55 in which the ink passage section 53 and the pressure room section 54 were formed of etching processing 56 is a piezoelectric device and 57 and 58 are electrodes.

[0004] Since the ink feed-hopper section 59 for an ink-jet head as shown in this drawing 4 sending ink liquid into the ink passage section 53 from an ink tank is formed in the side edge section of substrates 52 and 55, the ink feed-hopper electrode holder (not shown) for connecting an ink tube to the ink feed-hopper section 59 will protrude ahead from a nozzle side, i.e., the front face of the side-front substrate 52.

[0005] Therefore, distance between a nozzle side and the recording paper could not be shortened to some extent above, but it had barred improvement in a quality of printed character. Then, there are some which formed the ink feed-hopper section by etching processing from the rear-face side of a background substrate toward the ink passage section.

[0006] Drawing 5 forms the pressure room section 63 which stands in a row in the ink passage section 62 and it from the side front by etching processing to the background substrate 61 which consists of a silicon-single-crystal wafer, as the manufacture method of such a conventional ink-jet head is shown and it is first shown in (1). 64 is the oxidization protective coat (SiO<sub>2</sub>) made to generate all over both sides of the background substrate 61 beforehand for the protection to an etching reagent.

[0007] Next, after making the front face of the ink passage section 62 formed of etching processing, and the pressure room section 63 generate the oxidization protective coat (SiO<sub>2</sub>) 65 as shown in (2), as shown in (3) a nozzle — in order to join the side-front substrate 67 in which the hole 66 was drilled and which consists of a silicon-single-crystal wafer, for example to the background substrate 61 and to use the wall of the background of the pressure room section 63 as the diaphragm 68 of predetermined thickness — grinding — and it polishes

[0008] And after making the rear face of the background substrate 61 generate the oxidization protective coat (SiO<sub>2</sub>) 69 as shown in (4), from the background of the background substrate 61, the ink feed-hopper section 70 is turned to the ink passage section 62 by etching processing, and it forms, and as shown in (5), finally the oxidization protective coats 64, 65, and 69 are dissolved.

[0009] Thus, the ink feed-hopper section 70 is open for free passage from the rear-face side of an ink-jet head toward the ink passage section 62. Therefore, the ink feed-hopper electrode

holder (not shown) for connecting an ink tube to the ink feed-hopper section 70 cannot project from the front face of the nozzle side 71, but can shorten arbitrarily the distance between the nozzle side 71 and the recording paper.

[0010] In addition, the process shown in drawing 5 is illustrating only the main processes required for explanation, and illustration of a fine process portion is omitted.

[0011]

[Problem(s) to be Solved by the Invention] However, after making both sides of the background substrate 61 generate the oxidization protective coat 64 first and carrying out etching processing of the ink passage section 62 and the pressure room section 63 from a side front, it is necessary to make the processing side generate the oxidization protective coat 65 again in the manufacture method of the conventional ink-jet head shown in above drawing 5.

[0012] Otherwise, it is because an etching reagent flows into the interior of the ink passage section 62 and the pressure room section 63, the interior is melted and it deforms, in case the ink feed-hopper section 70 is formed by etching processing from a background.

[0013] However, since generation of such an oxidization protective coat 65 took time very much, the productive efficiency of the conventional manufacture method of performing this again not only by the beginning of a process but by the middle was a low thing.

[0014] Then, this invention aims at offering the manufacture method of an ink-jet head that the quality ink-jet head which has arranged the ink feed-hopper section to the rear-face side is efficiently producible.

[0015]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the manufacture method of the ink-jet head of this invention As opposed to the background substrate 1 which formed the protective coat 2 to etching in both sides beforehand as shown in drawing 1 and drawing 2 for explaining an example from the side front Depression 4a used as the ink feed-hopper section 4 is formed in the bigger depth than the thickness size of a diaphragm 5 by etching processing. Then, the pressure room section 9 which stands in a row in the ink passage section 8 and it so that the above-mentioned depression 4a may be included inside is formed from the side front by etching processing to the above-mentioned background substrate 1. It joins to the above-mentioned background substrate 1. next, a nozzle — the side-front substrate 11 in which the hole 10 was drilled — the nozzle — so that a hole 10 may carry out opening toward the above-mentioned pressure room section 9 in order to use the wall of the background of the above-mentioned pressure room section 9 as the diaphragm 5 of predetermined thickness — the rear face of the above-mentioned background substrate 1 — grinding — or it polishes, and by it, the above-mentioned depression 4a carries out opening to the rear-face side of the above-mentioned background substrate 1, and is characterized by the ink feed-hopper section 4 and the bird clapper

[0016] In addition, you may be made to perform junction to the above-mentioned background substrate 1 and the side-front substrate 11 after the grinding of the rear face of the above-mentioned background substrate 1, or the process of polishing.

[0017]

[Function] By [ which carry out etching processing of the ink passage section 8 and the pressure room section 9 from a side front further ] having carried out etching processing from the side front at the background substrate 1, it dents, and only the part of the 2nd etching processing is formed still more deeply, and 4a portions carry out opening of the rear face of the background substrate 1 to a rear-face side grinding or by polishing, and serve as the ink feed-hopper section 4.

[0018]

[Example] An example is explained with reference to a drawing. Drawing 1 and drawing 2 show the manufacture method of an ink-jet head in order of the process. The number in a parenthesis is the operation number. However, being illustrated is one of the injection elements of a large number which constitute an ink-jet head.

[0019] 1 is the background substrate made from the silicon-single-crystal wafer whose thickness which has a flat surface (100) is 300 micrometers, and makes the both sides generate

the oxidization protective coat for the protection to the etching reagent for silicon ( $\text{SiO}_2$ ) first in (2) from a process (1).

[0020] Then, in (3), after applying the resist 3 of upper shell photosensitivity of the oxidization protective coat 2 to the field of the side front of the background substrate 1, it sets to (4), the pattern of the ink feed-hopper section 4 is exposed and developed to a resist 3, and mask 4b which carried out opening to the pattern configuration is formed.

[0021] And in (5), etching processing ( $\text{SiO}_2$  etching) to the oxidization protective coat 2 of a side front is performed. Then, the oxidization protective coat 2 is melted by the configuration of mask 4b of an ink feed-hopper section pattern. In addition, the field of a background equips with the protection sheet so that it may not \*\*\*\*\*.

[0022] Next, a resist 3 is removed by (6) and anisotropic etching processing (Si etching) is given to the background substrate 1 by (7). Then, it \*\*\*\*\*s only the mask 4b portion from which the oxidization protective coat 2 of a side front was removed, and, as for the background substrate 1, depression 4a is formed.

[0023] With the ink-jet head of this example, the thickness of the diaphragm 5 mentioned later is set as 40 micrometers. Then, this depression 4a is deeper than the thickness size of a diaphragm 5, for example, \*\*\*\*\*s by 50-micrometer Fukushima.

[0024] Thus, if depression 4a which becomes the ink feed-hopper section 4 later is formed in the field of the side front of the background substrate 1, by (8), a resist 7 will be applied to the field of the side front of the background substrate 1, the pattern of the pressure room section 9 which stands in a row in the ink passage section 8 and it by (9) will be exposed and developed, and mask 8a which carries out opening to the pattern configuration will be formed. At this time, physical relationship is set so that it may dent in the pattern of the ink passage section 8 and 4a may be contained.

[0025] Then, by (10), only the oxidization protective coat 2 of a side front carries out etching processing ( $\text{SiO}_2$  etching). Then, the oxidization protective coat 2 is melted by the configuration of mask 8a of the pattern of the ink passage section and the pressure room section. In addition, the field of a background equips with the protection sheet so that it may not \*\*\*\*\*.

[0026] Next, by removing a resist 7 by (11) and giving anisotropic etching processing (Si etching) to the background substrate 1 by (12), it \*\*\*\*\*s only the mask 8a portion from which the oxidization protective coat 2 of a side front was removed, and, as for the background substrate 1, the ink passage section 8 and the pressure room section 9 are formed in the depth which is 50 micrometers.

[0027] Then, depression 4a already formed in a depth of 50 micrometers since before the etching becomes still deeper by this etching processing, and reaches a depth of 100 micrometers.

[0028] thus, the nozzle which will carry out opening to front reverse side both sides by (13) if etching processing to the background substrate 1 is completed — the side-front substrate 11 which a hole 10 becomes from the silicon-single-crystal wafer by which penetration formation was carried out is made to join and unite with the field of the side front of the background substrate 1 by for example, electrostatic junction, direct junction, etc. this time — a nozzle — physical relationship is set so that a hole 10 may carry out opening toward the pressure room section 9

[0029] (14) — one a210 micrometers only of rear faces of the background substrate 1 — grinding — and it polishes and the wall 5 of the background of the pressure room section 9 of the background substrate 1, i.e., a diaphragm, is formed in the thickness of 40 micrometers [ then, ]

[0030] Then, depression 4a currently formed in a depth of 50 more micrometers from the base of the ink passage section 8 carries out opening to the rear-face 1a side of the background substrate 1, and this opening serves as the ink feed-hopper section 4.

[0031] In addition, grinding and the process of polishing do not necessarily need to perform both grinding and polishing, and are good. [ of at least either ] Moreover, the junction process of (13), and the grinding of (14) and a polishing process may make sequence reverse.

[0032] Thus, if processing to substrates 1 and 11 is completed, the lower electrode layer 12 will

be fixed at the rear face of a diaphragm 5 by (15), and a piezoelectric device 13 will be attached by (16). 14 is an up electrode.

[0033] In the manufacture method of such an ink-jet head, oxidization protective coat generation in process is [ that what is necessary is just to perform beforehand oxidization protective coat generation to substrates 1 and 11 to the background substrate 1 first ] unnecessary. Moreover, to the side-front substrate 11, the beginning to oxidization protective coat generation is unnecessary.

[0034] In addition, as shown in drawing 3 , many (for example, 40 pieces) ink-jet heads 21 are formed at one silicon-single-crystal wafer 20 which forms substrates 1 and 11, and, finally can be carved into each ink-jet head 21. And 16 or 64 injection elements are formed in each of that ink-jet head 21.

[0035] In addition, this invention may not be limited to the above-mentioned example, and may use materials other than a silicon-single-crystal wafer for substrates 1 and 11, for example, may perform isotropic etching as etching processing.

[0036]

[Effect of the Invention] Since there will be no fear of pattern collapse of the ink passage section and the pressure room section even if it does not form a protective coat in the middle of future processes if the ink feed-hopper section is formed in the rear face of an ink-jet head according to the manufacture method of the ink-jet head of this invention and the etching protective coat is moreover first formed in both sides of a background substrate beforehand, a quality ink-jet head can be manufactured conventionally very efficiently in a short time.

---

[Translation done.]

**\* NOTICES \***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

---

**DESCRIPTION OF DRAWINGS**

---

**[Brief Description of the Drawings]**

**[Drawing 1]** It is manufacturing process explanatory drawing of an example.

**[Drawing 2]** It is manufacturing process explanatory drawing of an example.

**[Drawing 3]** It is the plan of the silicon-single-crystal wafer of an example.

**[Drawing 4]** It is the side cross section of the ink-jet head of the conventional example.

**[Drawing 5]** It is the conventional manufacturing process explanatory drawing.

**[Description of Notations]**

- 1 Background-Substrate
- 2 Oxidization Protective Coat
- 4 Ink Feed-Hopper Section
- 4a Depression
- 5 Diaphragm
- 8 Ink Passage Section
- 9 Pressure Room Section
- 10 Nozzle — Hole
- 11 Side-Front Substrate

---

[Translation done.]



## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.

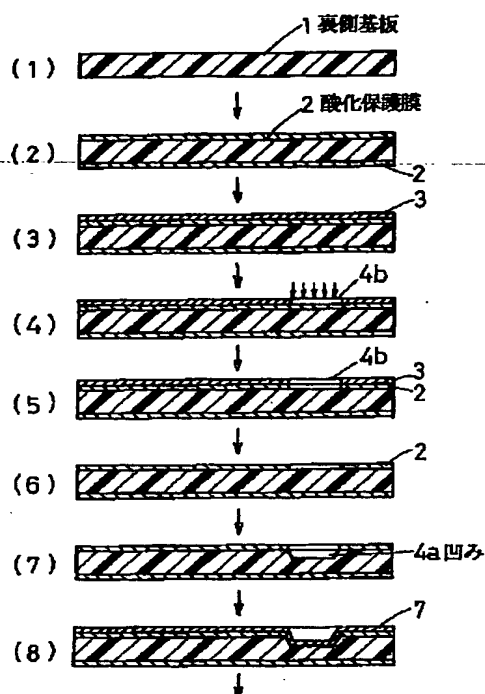
2.\*\*\*\* shows the word which can not be translated.

3.In the drawings, any words are not translated.

## DRAWINGS

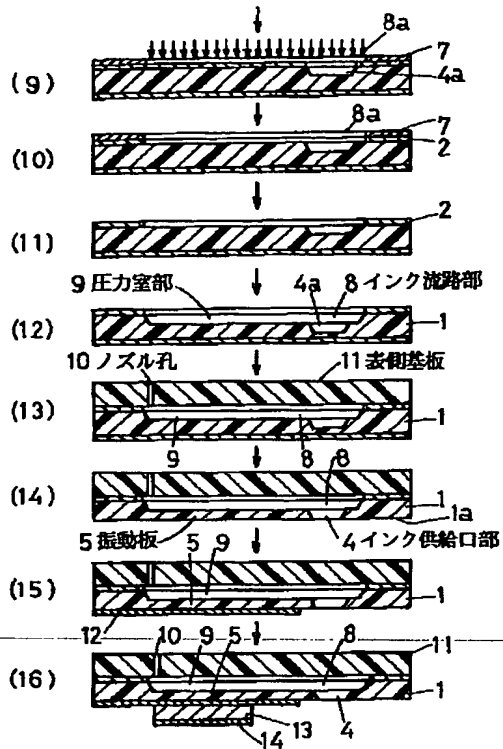
[Drawing 1]

実施例の製造工程説明図



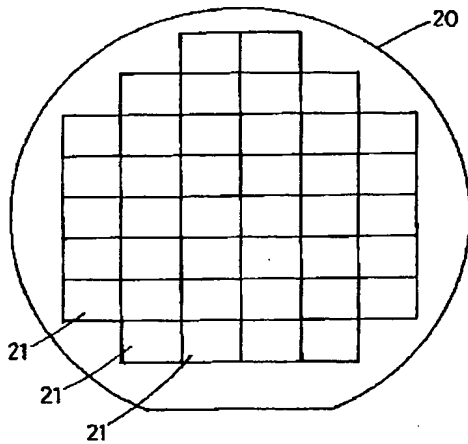
[Drawing 2]

実施例の製造工程説明図



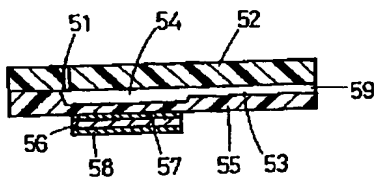
[Drawing 3]

実施例のシリコン単結晶ウェハの平面図



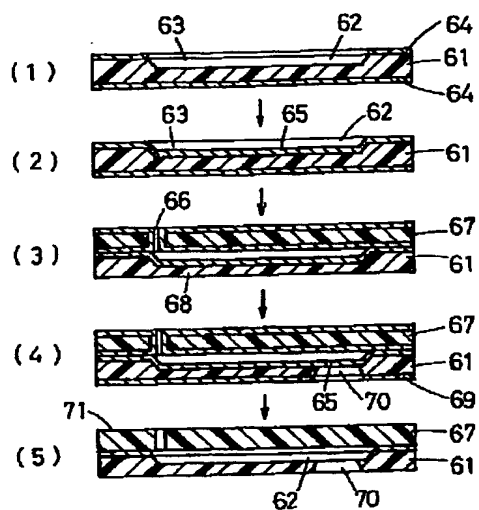
[Drawing 4]

従来例のインクジェットヘッドの側面断面図



[Drawing 5]

従来の製造工程説明図



[Translation done.]

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

☐ **BLACK BORDERS**

☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**

☐ **FADED TEXT OR DRAWING**

☒ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**

☐ **SKEWED/SLANTED IMAGES**

☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**

☐ **GRAY SCALE DOCUMENTS**

☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**

☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**

☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**